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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/535,682

07/01/2005

Bernd Fischer

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7590

09/18/2007

LARSON AND LARSON

11199 69TH STREET NORTH

LARGO, FL 33773

EXAMINER

BLOOM, NATHAN J

ART UNIT

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/535,682	<b>Applicant(s)</b> FISCHER ET AL.	
	<b>Examiner</b> Nathan Bloom	<b>Art Unit</b> 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 19 May 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) 1-10 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>06/27/2005</u> .  | 6) <input type="checkbox"/> Other: _____                          |

Art Unit: 2624

### DETAILED ACTION

As per Applicants' preamendment filed 05/19/2005 claims 1-10 have been cancelled and only new claims 11-22 are being considered.

#### *Claim Rejections - 35 USC § 101*

1. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The USPTO "Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility" (Official Gazette notice of 22 November 2005), Section IV.C, reads as follows:

While abstract ideas, natural phenomena, and laws of nature are not eligible for patenting, methods and products employing abstract ideas, natural phenomena, and laws of nature to perform a real-world function may well be. In evaluating whether a claim meets the requirements of section 101, the claim must be considered as a whole to determine whether it is for a particular application of an abstract idea, natural phenomenon, or law of nature, rather than for the abstract idea, natural phenomenon, or law of nature itself.

For claims including such excluded subject matter to be eligible, the claim must be for a practical application of the abstract idea, law of nature, or natural phenomenon. *Diehr*, 450 U.S. at 187, 209 USPQ at 8 ("application of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection."); *Benson*, 409 U.S. at 71, 175 USPQ at 676 (rejecting formula claim because it "has no substantial practical application").

To satisfy section 101 requirements, the claim must be for a practical application of the Sec. 101 judicial exception, which can be identified in various ways:

The claimed invention "transforms" an article or physical object to a different state or thing.

The claimed invention otherwise produces a useful, concrete and tangible result, based on the factors discussed below.

Claim(s) 11-22 is/are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claims 11-22 recite the mere manipulation of data or an abstract idea, or merely solves a mathematical problem without a limitation to a practical application. A practical application exists if the result of the claimed invention is "useful, concrete and tangible" (with the emphasis on "result")(Guidelines, section IV.C.2.b).

Art Unit: 2624

A “useful” result is one that satisfies the utility requirement of section 101, a “concrete” result is one that is “repeatable” or “predictable”, and a “tangible” result is one that is “real”, or “real-world”, as opposed to “abstract” (Guidelines, section IV.C.2.b)). Claims 11-22 merely manipulate data without ever producing a useful, concrete and tangible result. The claims as written merely minimize and measure the displacement, convergence, and smoothness of a specification solution between the two points. This measurement produces no useful, concrete, or tangible result.

In order to for the claimed product to produce a “useful, concrete and tangible” result, recitation of one or more of the following elements is suggested:

- The manipulation of data that represents a physical object or activity transformed from outside the computer.
- Physical transformations outside the computer, for example in the form of pre or post computer processing activity.
- A direct recitation of a practical application;

Applicant is also advised to provide a written explanation of how and why the claimed invention (either as currently recited or as amended) produces a useful, concrete and tangible result.

***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

Art Unit: 2624

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 11-12 and 14-22 are rejected under 35 U.S.C. 102(b) as being anticipated by Backircioglu (US 6633686).

Instant claim 11: (new) Method for the registration of images by iterative determination of an optimum transformation with respect to a predetermined distance and smoothness criterion, wherein control points corresponding in the images can be imaged on one another in guaranteed manner, the steps of the image registration method comprising:

(a) initializing an iteration counter and displacement field; [*Displacement field initialization: lines 20-23 of column 9. In lines 37-40 of column 9 it is stated that the algorithm is repeated until convergence of a maximum number of iterations is reached which means that the number of iterations is tracked and thus at some point at the beginning of the process a counter must be initialized.*]

(b) determining the numeral solutions of the nonlinear partial differential equation (PDE) with the differential operator derivable from a predetermined smoothness criterion and the point evaluation functions located at the predetermined control points; [*Lines 35+ of column 10 and lines 1-15 of column 11 defines solutions derived from smoothness criterion and the point mapping function  $u(x)$ . Also for use of PDE see lines 40-55 of column 22, and in line 3 of column 11 the solution of the nonlinear problem by creating a series of linear solution solved in small steps.*]

(c) combining the interpolation conditions; [*Lines 50-55 of column 9.*]

Art Unit: 2624

(d) calculating a specific, numerical solution of the PDE with the force determined on the basis of the distance criterion and the actual displacement field, the differential operator derived from the smoothness criterion; [*Lines 25+ of column 10 and lines 1-15 of column 11, and lines 1-40 of column 9. For numerical solution of PDE see lines 40-55 of column 22 (refers to material that is included by reference.)*]

(e) evaluating the specific solution at the control points; [*Lines 1-40 of column 9 and line 55 of column 9 to line 15 of column 11.*]

(f) determining the coefficients for calculating an updated displacement; [*Lines 1-40 of column 9 and line 20 of column 10 to line 45 of column 11.*]

(g) updating the displacement field and raising the iteration counter; and [*Lines 1-40 of column 9 and line 20 of column 10 to line 45 of column 11.*]

(h) checking the displacement for convergence. [*Lines 35-41 of column 9.*]

Instant claim 12: (new) The image registration method of claim 11, wherein steps (d) through (h) are repeated for non-fulfillment of the convergence criterion. [*Lines 35-41 of column 9, and see rejection of claim 11 step (a).*]

Instant claim 14: (new) The image registration method of claim 11, wherein displacement is updated by means of the increment of the displacement or its time derivative. [ *$u(x)$  as shown in equations 13-21 in columns 9-11 are updated incrementally in each iteration. See lines 55 of column 10 to line 15 of column 11.*]

Art Unit: 2624

Instant claim 15: (new) The image registration method of claim 11, wherein one, two or three-dimensional objects are registered. [*Lines 7-21 of column 10.*]

Instant claim 16: (new) The image registration method of claim 15, wherein the sequence of one, two or three-dimensional objects are registered. [*Lines 45+ column 5 and lines 7-21 of column 10 wherein a plurality of objects is registered (plurality of objects is a sequence of objects).*]

Instant claim 17: (new) The image registration method of claim 11, wherein the control points are anatomical landmarks, fiducial markers or other quantities. [*Lines 7-21 of column 10.*]

Instant claim 18: (new) The image registration method of claim 11, wherein the distance criterion is based on intensity, edge, corner, surface normal or level set or on the sum of square differences,  $L_2$  distance, correlation, correlation variants, mutual information or other variants. [*See column 8 and in particular lines 40-50 wherein the quadratic distance measure is used (other variants).*]

Instant claim 19: (new) The image registration method of claim 11, wherein the force terms of distance quantity are calculated by means of finite difference methods or gradient formation. [*Lines 58-65 of column 8 (gradient descent is used) and lines 1-44 of column 11 (equations 21 and 22) wherein  $f(x)$  is the force term.*]

Art Unit: 2624

Instant claim 20: (new) The image registration method of claim 11, wherein smoothness criterion is enforced by means of an elastic potential, fluid approach, or diffusive or curvature approaches based on time and space derivatives. [*Lines 45-55 of column 10.*]

Instant claim 21: (new) The image registration method of claim 11, wherein boundary conditions of the differential operator are specified as explicit or implicit, Neumann, Dirichlet, sliding, bending or periodic. [*Lines 7-25 of column 15.*]

Instant claim 22: (new) The image registration method of claim 19, wherein discretization of the differential operator is based on finite differences, finite volume, finite elements, Fourier methods, series expansions, filter techniques, collocations or multigrid. [*Column 8 equation 12 (series expansion of  $u(x)$ ).*]

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Backircioglu (US 6633686).

Instant claim 13: (new) The image registration method of claim 11, wherein the interpolation is performed d-dimensionally by means of splines or wavelets. [*As per rejection of claim 11 step*



Art Unit: 2624

*(c) the use of interpolation between grid points has been taught, but the particular type of interpolation was not specified. Examiner takes official notice that the use of spline and wavelet interpolation was notoriously well known to one of ordinary skill in the art at the time of the invention. Furthermore, the use of these interpolation techniques as well as any other known techniques would've been obvious to one of ordinary skill in the art as they provide efficient and accurate interpolation results.]*

### ***Conclusion***

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Fischer ("Curvature Based Registration with Applications to MR-Mammography") – Broader disclosure of currently claimed invention (35 USC 102(b) date).
- Fischer ("A Super Fast Registration Algorithm") – similar disclosure to that of currently claimed invention with use of iterative algorithm (35 USC 102(b) date).
- Modersitzki ("Non-Linear Image Registration on PC-Clusters Using Parallel FFT Techniques") – elastic matching algorithm using iterative techniques.
- Peckar ("Linear and Incremental Estimation of Elastic Deformations in Medical Registration Using Prescribed Displacements") – elastic deformations using successive linearization of the non-linear equation.
- Hermosillo ("A Variational Approach to Multi-Modal Image Matching") – elastic deformations using regularization and linearized models.

Art Unit: 2624

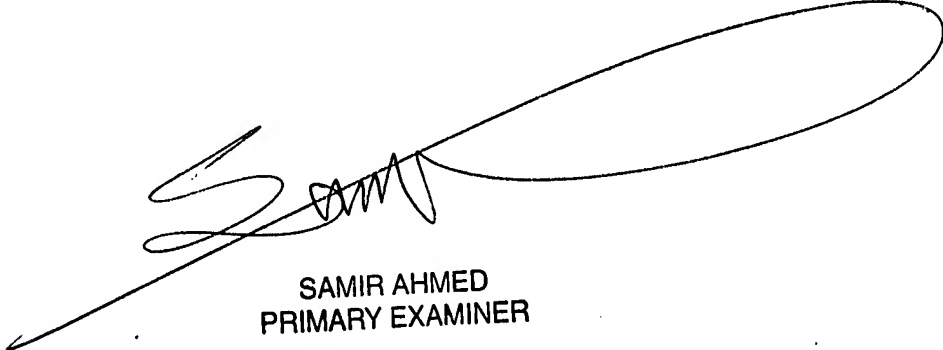
***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan Bloom whose telephone number is 571-272-9321. The examiner can normally be reached on Monday through Friday from 8:30 am to 5:00 pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Samir Ahmed, can be reached on 571-272-7413. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nathan Bloom



SAMIR AHMED  
PRIMARY EXAMINER